

Council of State Governments Speech / Quebec City / 12/04/99
- DRAFT -

12/01/99

Thank you for the warm welcome. I'm eager to share with you today – members of the Council of State Governments - the unsurpassed progress of NASA's space transportation programs and **how** these innovations can and will impact you - at state and local government levels nationwide.

Many innovations are already in place, and I'll be sharing with you today the potential that was unimaginable only a decade ago.

[INSERT 01 here? – See what Art is comfortable with - see page three]

Our timing couldn't be better. There has truly never been a greater opportunity for us at the Marshall Space Flight Center to partner with you at the state and local government level.

Marshall, by the way, is one of ten field installations of NASA. However, only as a collective team have we been able to witness these never-imagined strides.

The milestones we are making in space transportation, technology transfer, and microgravity are having a direct impact down here on earth: in commercial transportation, more accurate weather

forecasting, improved medical procedures, more cost-effective manufacturing processes, and even law enforcement. Our emphasis on space has begun to provide real solutions on earth.

These are **shared** technologies – developed for space transportation, yet delivering solutions and breakthroughs that have already changed the lives of people all over the world. And we are seeing them help commercial and state governments more and more.

There are also shared programs and new concepts for inspiring and educating our youth - - or should I say – our future. What a great way to GROW into the new millennium!

Now this is exciting Virtually no modern industry has been untouched by the past four decades of space research and development. But more exciting is where we stand now.

As I mentioned, the time for bringing the technology to the state and local government levels, to the lives of our citizens, has clearly NEVER been better.

So, my question to you this afternoon is: “Are you ready to begin a new century with all the technological and educational advances NASA has to offer your state?”

I will also be sharing with you just how our technology transfer mechanism works, after you've heard about some promising innovations – many now in place.

INSERT 01: At Marshall, we believe that if we get too comfortable, we must not be growing, diversifying, or thinking broadly enough. I am proud to say that we are breaking down the walls of our comfort zones and partnering with private industry, state and local governments in ways we never imagined. The result so far has been a dynamic win-win relationship. What could be seen as “stressful” we see as an opportunity. Dr. Farris Jordan, an industrial psychologist, puts it this way: “Stress and change are the opportunities to create good news about yourself or organization.” At NASA, we think the time has never been better to create good news about you and ourselves – by sharing with you our advances. The comfort zone just isn't that exciting. Unless you enjoy stagnation and isolation.

I know with the CSG – that each of you believes that private sector involvement in the American governance system is critical in building sound solutions to our ever-increasing public policy challenges. I also believe that your best avenue to building those solutions is to make yourself known to us – and we'll do likewise.

Let us know what your stakeholder's technology concerns are. Let us discuss with you the access to our resources. I'll cover the “how-to”

details of this. There may be some abstract ideas; some specific ones. But there will be ideas. And that's how we get started. Our goal is to demonstrate the impact of our technology at the state and local government level - and then build on this.

We need your help in identifying the partnerships – to build that involvement that you already realize is critical. Let me share with you some recent innovations we have built upon at Marshall that are already being practiced at the state and local government level.

I'd like to break these into two topical areas – technology and education. With all that's happening in each area, it's a challenge to share it all with you in a few short minutes. However, I do invite you to participate in the Q&A session afterwards.

Back home, I'm sure that one of the most frustrating issues you are up against daily is environmental management within your state and cities. Citizens, watchdog groups, and others want answers. You want solutions. Strong economic growth and progress come with a price-tag - higher urban pollution and coping with ever-increasing temperatures in our larger cities.

NASA has already become a key partner with several of your state and local governments in addressing this problem we call **Urban Heat Islands**. The Global Hydrology and Climate Center (GHCC) in

Huntsville, AL, working with the U.S. EPA and several local governments, are conducting Urban Heat Island Experiments in several major cities right now.

I'd also like to point out that the GHCC is a joint venture by NASA's Marshall space Flight Center, the Universities Space Research Association, and the Space Science and Technology Alliance of the State of Alabama. This solid partnering approach has driven the success of this program.

Urban heat islands are a distinct 20th century phenomenon. We all know that today's asphalt and concrete urban areas get much hotter during daylight hours than rural or vegetated areas. Especially in the summer.

You may not feel this as much here in Quebec City, but if you've traveled south during the summer, you know what I mean. Anyway, this build-up of heat gets stored and then released during the night. The result?? Domes of hotter air released over cities and formation of unique weather patterns. These virtual domes actually make a city retain more of its concentrated air pollution that was generated during the day.

Most of you can see the cause/effect scenario here more heat, more smog, and increased air conditioning use, which can drain city's power supplies.

Our solution to helping control this problem is exciting.

By using our advanced satellite and infrared imaging techniques, we have begun to help cities identify, isolate, and gain control of the situation. I'll briefly explain how this works.

At NASA, we initially launched a 1997 campaign in Atlanta, GA, to study extreme heat in this urban environment. Since then, we've gathered data for three other major cities: Baton Rouge, Sacramento, and Salt Lake City. Most of this data was gathered just last year.

Other cities planned for satellite-data studies include Houston, Chicago, Los Angeles, Nashville, Phoenix, and Tucson. The lessons learned will not only provide recommendations to these cities, but could guide other cities as well.

Imagine the impact of this single technology in just 20 years. Well, we are on our way – along with you to make it happen.

We're using aerial remote sensing data in conjunction with meteorological measurements. This has allowed us to develop numerical models of land-atmosphere interactions. This data we collect builds highly reliable models that relate land cover change through time with the flux of surface energy. By land cover, I'm referring to trees, shrubs and other vegetation.

[OVERHEAD: aerial infrared shot of Atlanta].

(Description of overhead: Atlanta aerial shot shows concrete and asphalt glowing bright in thermal infrared, while trees and other vegetation are darker because the sun's energy is being dissipated mostly through evaporation of water through their leaves.)

Once we gather this data, we make recommendations to a city, such as future land-cover changes and how these changes will affect the local and regional climate and air quality over the city.

This approach goes way beyond just saying "plant more trees and shrubs in your cities." It clearly identifies when, where, and how much land-cover will minimize temperature increase. It also predicts WHERE the most probable hot-spots are emerging.

I believe the benefits of this technology will eventually be used by even mid-sized cities. What better way to manage and control urban growth than by understanding where your hot pockets could be before it's too late?

Simply put, strategically planned urban forests are critical to keeping cities cool. And, although the heat island effect has been known for a long time, little has been done to measure it in a quantifiable way that governments and other decision-makers can use in planning cities. The challenge has been faced and the solution is being delivered.

Keeping our cities cooler in the future will be a true milestone, but keeping the “heat in the streets” down is another challenge we all face. Crime prevention – a new area of partnering with NASA, has already received national attention. At Marshall, we have recently developed a video imaging technology that has already proven itself as a breakthrough tool for law enforcement. We call this innovation VISAR, which stands for *Video Image Stabilization and Registration*. By the way, that's the first acronym I've used this afternoon! I'll try to keep up the good work.

VISAR clearly gives new meaning to the phrase “caught on tape.” Now, this technology may soon be helping state and local law enforcement officials around the country solve crimes.

VISAR actually began over two years ago at Marshall. Two of our inventors, Dr. David Hathaway and Paul Meyer, had received a request from the Southeast Bomb Task Force of the FBI to improve video of the bombing at the 1996 Olympic Games in Atlanta.

The software clarified the dark, nighttime videotape made with a handheld camcorder. By doing this, our team was able to reveal important details that were previously undetected.

Let me give you a brief description of how VISAR works.

VISAR technology improves the clarity of video footage by correcting distortion. It stabilizes camera rotation and zoom effects, produces clearer images, and reduces video noise or “snow.”

For more detail in description (if needed):

(This is all done by a computer algorithm developed by Hathaway and Myer that analyzes video frames pixel by pixel and corrects the distortion.)

Dr. Hathaway, a solar physicist at Marshall, and Myer, an atmospheric scientist, combined their efforts to make this technology happen. Neither had any idea how their invention would be assisting more down-to-earth needs – potentially at local state and city

government levels nationwide. Just one more opportunity where being a partner was being a winner.

Just this year, VISAR was introduced at a conference sponsored by the Office of Law Enforcement Technology Commercialization, which is part of the National Institute of Justice. Our team presented a video of a mock car chase, then showed how VISAR was able to clarify the license plate of the fleeing car.

As we see VISAR being integrated into the commercial and state government levels, the application potential with law enforcement and security video surveillance are evident.

Also, beyond law enforcement, VISAR may be used in meteorology, to better track cloud formation and storms. Other uses include medical imaging, scientific applications, and instant replays of sporting events.

Even home videos, eventually, could benefit from VISAR. We all have that special shot of a wedding, graduation, or baby's first steps – that is less than clear. Very soon, from a home computer, the too dark or blurry shots that you once thought were no good - could be fixed.

What a range of potential solutions from one single technology!

In both of these technologies, I have mentioned potential benefits to better weather forecasting. I'd like to expand on this for a minute, especially since our nation's pattern for intense, unpredictable weather seems to be increasing each year.

NASA's Global Hydrology and Climate Center, managed by Marshall in Huntsville, is our scientific "powerhouse" for climatology research in the Southeastern United States. I'm proud to say that the Global Hydrology Center and the university community are working together, as never before, toward a future of improved hurricane and severe storm prediction for your state – your region. Advances are also being made in more reliable day-to-day weather forecasting.

Let me give you a recent example. Since 1995, NASA lightning researchers have launched two imaging devices into space – the Optical Detector and the Lightning Imaging Sensor. The purpose of these devices is to gather and relay information to researchers on earth about lightning and thunderstorm activity around the globe.

No doubt, these sensors are paving the way for space-based lightning mapping and plotting. It will have the capacity to deliver continuous, global lightning information to forecasters within seconds.

The science of “forecasting” shifting to one of “nowcasting” will give people anywhere in the world earlier warning of severe storms. Imagine the potential life-saving possibilities.

So, are you starting to see the direct impacts of space-based research – here on earth? This is truly a new era for NASA, and a new opportunity for our technologies to be shared with you.

There are a couple of more “latest and greatest” technologies at NASA-Marshall I’d like to share with you that are having a direct impact at the state and local government levels. Then I’ll shift over to some of our new partnership programs in education to conclude.

As you face growth and expansion in your states, the challenge of better transportation is always staring at you – especially in our larger cities. Nationally, all of you are looking at ways to improve yet control cost of new transportation systems.

The high-speed magnetic-assist rail transportation alternative tends to be overlooked in the United States. Yet, it is constantly gaining popularity in Europe and Japan.

The operational costs, safety issues, and pollution concerns with our current, diesel-powered rail transportation systems have kept federal and many state governments less than excited to look at new

approaches. Change, however, is inevitable and in this case could be revolutionary.

At Marshall, we are seriously looking at a new launch-assist called Maglev – short for magnetic levitation. That was ALMOST an acronym. (laughter) It's a way for us to magnetically accelerate a vehicle on a horizontal track to over 500 mph, then shifting to rocket engines for launch to orbit.

We just built a 50-foot magnetic levitation system this summer. Eventually, we'll have a 900-foot system. By the way, at 900 feet, that same system could be used for electro-magnetic catapult of planes from aircraft carriers.

By providing initial levitation and acceleration through a magnetic field, we will save enormous amounts of rocket fuel normally used for initial lift-off.

So, what could this mean for your future state and local transportation issues? Hopefully, it means partnering, sharing technology, again and again. The lessons learned from our shared MagLev research will be an open book for quicker and better development of high-speed trains. The advances that we make can also be yours.

OPTIONAL:

[Until newer, high-speed electro-magnetic trains are proven to have the reliability, safety, efficiency, and cost savings benefits, the passenger rail developers in this country will mostly sit in the comfort zone. However, for us at NASA, the comfort zone just isn't that exciting!

We realize our opportunity at NASA is to help usher in this new transportation era. And, as I have said, there has never been a better time to get on board - - no pun intended.]

So, at Marshall, we're working on a solution – that solution is Mag-lev – and it may revolutionize the way we send a vehicle to orbit. Again, by sharing, partnering, and involving the commercial and private sectors, why not revolutionize public rail transportation while we're at it.

And while I'm talking about our space transportation spin-off advances, there's another NASA aerial technology that is getting national attention – in agriculture.

We have started to share our remote sensing capabilities to help better control crop management. We call it Precision Farming. Our goal is to work with farmers at select test sites, using remote sensing

for improved crop management and better harvests. Here's how it works:

With remote sensing, airplanes fly over crop fields and map sections as small as two meters. Remote sensors then measure electromagnetic radiation, including the thermal energy of that target area. What these thermal studies provide to us and the farmers are never-before seen clues to plant quality, soil makeup, mineral variation and organic carbon content.

The result? More efficient use of fertilizer, better yields, and improved environmental protection. By environmental protection, I mean better detecting pesticide and chemical runoff patterns, and better controlling this.

Although we started with only six farmers to participate in this exciting research, the technology shows a lot of promise. I believe this is one more of NASA's programs that directly offers our data and expertise - to the states, counties, and others that can benefit from it the most. A better world starts each day that we roll our sleeves up a little higher and dig in a little deeper.

Doing this requires new, maybe unfamiliar partnerships, but exciting ones. The rewards of those efforts, however, will clearly make the world a better place.

Although I am sharing with you only a few areas of technology and potential partnerships this afternoon, I wanted to highlight some applications that could have the most immediate, results-driven benefits to you - at the state and local government levels.

In other words, I wanted to speak on state government issues where the rubber is meeting the road, instead of abstract, hazy ideas. And speaking of “the road,” we at Marshall have a spin-off technology that has already promised to make overpasses and bridges safer during wet or icy conditions.

Again, this resulted from a partnership between Marshall, the Federal Highway Administration, the Alabama Department of Transportation, and USBI.

We had developed a special coating around 1992, called ***Convergent Spray***, - an environmentally-friendly way to apply thermal protection to our solid rocket boosters. Our technology-transfer folks saw the extreme durability of this coating and recognized another potential “down-to-earth” application – as a skid-resistant coating for bridges and overpasses. The coating minimizes skidding in both icy and wet road conditions.

So, we did a series of tests in labs at Marshall, and then, quite frankly, *hit the streets*. At 9:00 a.m., an overpass section was coated. By 4:00 p.m., the road was re-opened to traffic. The Alabama Department of Transportation did its own series of tests on the overpass every 60 days. After two years, the coating is still intact and skid resistance is at a minimum.

As you well know, the standard process of closing a road, preparing the surface and recoating can take several days, if not weeks, not to mention the manpower and materials cost overruns. We were finished in one single day.

Although this technology is still not commercialized – the contractor we partnered with owns the rights – we took space-derived technology and helped solve a problem. A problem that you face back home everyday. It is my hope that this technology will be commercialized soon. . . . A shared technology and a direct solution.

Now I mentioned in my opening some NASA advances for medical applications. Although there are several, I'd like to share one in particular that is helping battle one of our biggest medical challenges – cancer treatment.

In our micro-gravity research program back at Marshall, a special lighting technology developed for commercial plant growth in space is

now helping conquer cancer. These lighting experiments have already helped treat patients and save lives.

A small 9-inch LED probe, consisting of 144 tiny pinhead-size diodes is the tool used for the treatment. It is technically called photodynamic cancer therapy. Quantum Devices, our industry partner, had taken the device beyond its function in space and brought it to the lives of those suffering.

We partnered with Quantum through NASA's Small Business Innovative Research Program. Had this partnership never happened, the benefits of this technology may have stopped at just plant growth. But this is an example of the synergy that is created when we partner. Great minds from NASA and private sectors come together to make revolutionary advances we would never make alone.

I've covered several space-based technologies this afternoon. I have also talked about their impacts – both now and their promise for the future. I have also mentioned several times the opportunity for partnerships between NASA and potential commercial alliances with you and your communities.

The mechanism we use to make technology transfer happen is through our *Space Act Agreements*. Space Act Agreements have

served as the bridge to many of our successful partnerships. I only see this trend increasing.

I'll define Space Act Agreements, and then bridge into some of our latest educational and outreach efforts. It's one thing to talk about all the "what-ifs" and "could-be's." However, without an easy to understand, formal process to link us, it's all just talk.

By utilizing our Space Act Agreements, which is simply NASA's tool for partnering with state governments or organizations, we have successfully bridged the relationship between NASA and the commercial and private sectors.

What were once just "hopes" for many of our technology partners, now exist as reality. Having the hope first is important. It builds the vision. And, as Thomas Fuller quotes: "Great hopes make great men." I suggest we let those hopes move us toward greatness.

Our Space Act Agreements simply document and establish the requirements for the product(s) or service(s) and the necessary resources that accomplish the objectives of the Agreement. From that point on, the hope becomes a vision. And that vision quite often becomes a new partnership.

For those of you who might be interested, the “how-to” details for partnering with NASA are covered in this booklet (**hold a copy up**). I brought along a stack of these. They will walk you through the process and show you how to put Space Act Agreements to work for your state government’s business partnerships.

(Identify where booklets are – who will distribute, etc.) In an effort to save time today, I encourage you to look through this booklet and think of the words “new opportunity” and “partnerships.”

We all know, however, that no matter what potential a new technology promises, without a proactive education program to inspire and motivate, it’s mostly unshared and underutilized. Educational solutions, then, require a consistent effort to get the word out, and keep our publics involved.

At NASA, our education programs and products make up that effort. For us, these programs are a top priority to the state, local and national community. We have a spectrum of programs for kindergarten through post graduate levels.

Many of today’s students see technology as a gateway to great adventure and exploration. They know that it is possible to reach the moon, and they can even imagine a space station and inhabited lunar and Martian outposts. What we must do is prepare these students to

make their dreams become a reality. We must give them the tools to develop and optimally use technology that will push us beyond the boundaries that today define our world.

Our educational goals are robust, yet achievable. I believe our conviction to deliver only the best educational programs have put us in this leading position. We expect from them a return on our investment in the form of exceptional engineers, scientists, and citizens.

We expect this, because what has to be done in the space business will require a lot of will. Not just “business as usual.” We try to follow the old Chinese Proverb: “Great souls have wills; feeble ones have only wishes.” We try to move beyond the wishes daily. And we want to instill in our youth both great souls and strong wills.

At NASA, our commitment is to provide accessible, comprehensive and accurate outreach tools to our publics. With this in place, the organizations, state governments and educators are always in the loop of what, when and where NASA can help.

We want to optimize our educational efforts to better serve the needs of those in this room today – not to mention our many other educational partners. So, we need to keep this avenue to our

educational products wide-open – free of roadblocks. If you can get to the information, the benefits are immeasurable.

[An appropriate quote here : “The greater half of knowledge is knowing where to find knowledge.”]

NASA is providing new educational products each year, which are used by NASA education staff at NASA-sponsored workshops and events. I’m especially proud that our educational people are out there in the public – state-by-state.

They are there to deliver the latest and greatest of what NASA is doing for those who are responsible for educating our children and ensuring the future of this country. “Those” include the span of K-12, higher education, and continuing education. We have a strong belief in “educational excellence for all.”

Before I summarize some select educational programs, I’d like to give you a few impressive numbers. Not too many, but enough to paint the picture of where our educational programs are going.

In FY98, Marshall provided in-person support for 42,685 educators, and 416,774 students, representing 663 educational institutions in all 50 states. By the way, these numbers do not include website traffic. During this same period, Marshall placed over \$130M on 506 grants,

contracts and cooperative agreements with 183 educational entities throughout the country.

Also, the Marshall Center donated over \$6.7M in excess computers and other research equipment to both pre-college and post-secondary schools. These numbers paint a picture that I'm quite proud of. Now let's talk about some particular programs.

Most of our educational products can be electronically retrieved. They are available on SpaceLink, our award-winning database for educators. SpaceLink is still NASA's premiere electronic resource for educators. You can download any of the Spacelink resources. And then, print and distribute as you wish.

I urge you to take a visit to SpaceLink. You can get there by logging onto spacelink.nasa.gov. (Note: have www address on an overhead). We currently have a search engine with over 300,000 web pages indexed for easy access by educators and administrators.

During any given month, the SpaceLink site receives over 5.5 million "hits" from our users. Teachers throughout the world routinely log on. Since January '97, SpaceLink hits have increased from just over 900,000 per month to over 5 million.

And just last March, USA Today recognized SpaceLink as its “Hot Site of the Day.”

I brought along a stack of business-card sized SpaceLink cards (hold one up?) for you to take back with you. If you didn’t write down our web address, it is on the card. Make sure to pick one up before you leave.

If you only need published versions of some of our materials, these are available through your NASA Educator Resource Center (ERC) that serves your region.

There’s the third acronym – not bad for 30 minutes. I encourage you to check SpaceLink for the address of your region’s location.

When it comes to meeting the educational needs of our country – state by state – our *Linking Leaders Program* is a shining star. It is a collaborative activity of NASA and the National Alliance of State Science and Mathematics Coalitions.

Linking Leaders isn’t just ONE national program, but 50, state-based programs that proactively bring together state leaders in education, business, and public policy (the legislative bodies). This process ensures that each state’s unique needs are being fulfilled. So, how do we do this? By asking a simple question.

The basic question we ask these leaders is:

“What is your agenda for math and science at the state level – so we can help you reach your goals?” Our goal is to make public what we do every day at NASA as a magnet for learning.

By sharing our three key resources: people, facilities, and missions, the *Linking Leaders Program* makes these resources available to educational facilities around the country. We are constantly expanding NASA interactions with education stakeholders like many of you at the state and national levels.

All of our education programs at NASA are grounded on four operating principles. These are:

- Customer focus,
- Collaboration,
- Diversity, and
- Evaluation

They drive the educational and outreach process. All four of these principles allow us to continue existing and establish new alliances.

And, as this process expands, we connect NASA Principal Investigators, NASA-trained teachers, existing NASA education resources, and commercial contractors with the State education leadership. This way, we can determine how these assets may best be utilized within YOUR states.

On a local level, back at Marshall, we have a promising new program that brings similar resources together working on regional issues. We call it BEST, for Business/Education Success Team. Now at least that's an easy acronym.

BEST is a staff development committee co-created by the Huntsville/Madison County Chamber of Commerce. On the committee are educators, government representatives and business entities – who meet together once a month and focus on workforce preparedness and development in our county.

One of the key goals of BEST is to better determine and understand our unique manpower needs of the community. It's a tremendous opportunity in helping the local community. And we believe that by helping in this way, you help build meaning and purpose for your citizens – not to mention encouraging Marshall to deliver its best.

And, as David O.McKay quotes: "Find a purpose in life so big it will challenge every capacity to be at your best." Well, we are reaching for purposes just like this. Each new pursuit must support in making us continue to be our best.

Our BEST committee also has created the local Hands On Work Experience Program. This is an ongoing effort to provide an

opportunity for two local educators to intern at the Marshall Space Flight Center. Again, it's simply a great way to share resources while preparing bright young people for challenging careers in science and technology. Partnering is the way we make this win/win strategy work.

I know that your local chambers could benefit from what we've learned. We'd like to share that with you. The proven infrastructure of this program could be easily replicated in your state or local government communities. And as I've said, the time has never been better.

We also have inspiring local programs at Marshall like SHARP (Summer High School Apprenticeship Research Program), which arranges for about 25 promising high-school students – primarily the underrepresented – to work in our Center laboratories.

Most important, these students are mentored individually by our scientists and engineers. Here, they gain valuable experiences in engineering and scientific research. And who knows just how many young lives we reach – and help direct towards a career in science or aerospace.

Let me share a couple more local programs that I believe will interest you.

The North Alabama Science Center is a hands-on, non-profit science education center located on the Calhoun Community College Huntsville campus. We provide a Marshall manager, on loan, to serve as interim director, facilities support, speakers, excess computers, and advisors. Additionally, Marshall awarded the Science Center a \$125K grant in 1988 for the development of curriculum materials.

Our focus on hands-on educational experiences is an obvious passion for us at Marshall. At our New Century Technology High School, students are exposed to the technologies they must master to work in Huntsville's high-tech industries. This program is actively supported by local businesses and NASA. Marshall provides the projects and mentors for the students. Also, a staff member serves on the school's advisory committee.

These local partnerships may give you ideas for your city or state. If they do, let's build on the idea. Knowing that you are helping create something that will influence the lives of other young people is quite rewarding. I like the way Ralph W. Sockman puts it: "What makes greatness is starting something that lives after you."

Statewide, Marshall's educational focus is very evident. We have an intriguing program called GLOBE (Global Learning and Observations to Benefit the Environment). Here, throughout the state, students

make environmental observations at or near their schools and then report their data to a GLOBE archive.

They then use the collective results from students throughout the world to study environmental topics in their classrooms. GLOBE in Alabama has recruited, trained and mentored more than 350 Alabama teachers. This is truly partnership at work.

All of these education and outreach programs couldn't be as successful as they have been without the key partnerships and collaborations. Here is a recent listing of who we partner and collaborate with to bring the best educational programs and products.

(OVERHEAD: "Partnerships & Collaborations")

I have shared with you several innovative educational and outreach local and state-wide programs. I'll wrap things up today by briefly summarizing some of our national educational programs. This way, you can think about our programs at each level – local, state, and national. Then ask yourself – where are the opportunities for my state?

I have already mentioned SpaceLink. But just to clarify, this educator's database is not just national – it is worldwide.

On a national and even international level, our Teacher of the Year and International Space Camp programs have had a phenomenal response rate. We collaborate each year with the Space & Rocket Center back in Huntsville to provide a one-week Space Camp for more than 50 notable U.S. Teachers of the Year. That's one teacher for each state and territory. Teachers are also included from about 30 countries throughout the world. Through our Education Programs Department in Huntsville, NASA provides all the funds for the U.S. teachers to attend.

The diversity, exchange of ideas and rewards of the event go beyond explanation. I can only imagine the inspiration and new perspective that the teachers take back home with them.

Another national educational program receiving much attention is our NASA Educational Workshops. These two-week workshops are conducted every summer at EVERY NASA Center, including Marshall. The partnering experience is phenomenal.

Teachers observe and interact with NASA scientists, engineers, technicians, and education specialists at work. Through this interaction, the teachers explore new ways to incorporate NASA discoveries and research into their math and science curricula. Just

last year, 13 states were represented at the Marshall workshop last year. There is always room for more participation.

For our upper-level graduate students, NASA awards fellowships each year to promising US graduate students whose research interests coincide with NASA's mission. These awards allow students the opportunity to spend a period in residence at Marshall. Just this past summer, we had 39 students to participate at the Center, each receiving a \$23K fellowship award.

And our Summer Faculty fellows program awards approximately 50 research fellowships to university faculty through the American Society for Engineering Education Summer Faculty Fellowship Program. These faculty researchers spend approximately ten weeks during the summer working hand-in-hand with their professional peers on research projects.

I'll conclude our education and outreach programs with an activity that seems to symbolize NASA-Marshall's passion for involvement, partnership, challenge and new knowledge. We call it the Great Moonbuggy Race. Besides being just plain fun, this annual activity inspires and gives participants a true hands-on approach to problem solving.

We started the Great Moonbuggy race in 1994 to commemorate the 25th Anniversary of the Apollo 11 lunar landing. The event is held each spring in Huntsville. This project is the absolute essence of community involvement and shared knowledge.

For the competition, students representing colleges, universities, and often high schools, design, build and race a vehicle that must address a series of engineering problems – just like the original Lunar Roving Vehicle encountered. Each moonbuggy is human powered and carries two students, one female and one male, over a half-mile simulated lunar terrain course. The course includes craters, rocks, lava ridges, and “lunar” soil.

Thirty-one teams from fifteen states and Puerto Rico are scheduled to participate this year.

I hope some of you will come to Huntsville this year to see the excitement, competition, but most importantly, the collective learning that is inspiring, challenging, and creating a new breed of problem-solvers. . . . Problem-solvers that we hope will be an active part of tomorrow’s science and technology leaders.

All of our educational programs, activities, and public involvement opportunities support our passionate endeavors at NASA to inspire

America's students, create learning opportunities, and enlighten inquisitive minds.

Whether an outreach program, a tech transfer program, or a spinoff technology derived from space transportation, the opportunities for partnering are right here – right now. The impacts of NASA to your state, local and regional governments, as I have said, have never been more evident. And now you know – the time has never been better than right now to create new partnerships, strengthen existing ones, and work together as never before.

At Marshall/NASA, our focus remains on making space transportation and research the cornerstone to a better life for all of us – our potential partnering with you will only enrich those endeavors.

Technology has its promise and education can help share the miracles of technology. But without the key resources – each one of you here today – so much can remain greatly underutilized.

On that note, I'll close with a quote from Elbert Hubbard: "One machine can do the work of 50 ordinary men. No machine can do the work of one extraordinary man."

I challenge us all to be extraordinary in our future partnerships.

Thank you for your time today.